IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Marc Bednarz, et al.

Serial No: 10/506,386

Filed: September 2, 2004

For: METHOD FOR INERTING THE ANODES OF FUEL CELLS

Examiner: Eugenia Wang

Art Unit: 1745

Mail Stop: Appeal Brief-Patents
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

AMENDED BRIEF ON APPEAL

SIR:

This appeal is taken from the Final Action mailed May 20, 2008.

Real Party in Interest

The real party in interest in the above-identified application is:

MTU CFC Solutions GmbH

Ludwig-Bölkow-Allee

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Germany

Related Appeals and Interferences

There are no related appeals or interferences of which Applicants are aware regarding the above-identified application.

Status of Claims

Claims 1-9 have been canceled and claims 10-16 are pending in the application. Claims 14-16 have been withdrawn as drawn to a non-elected invention. Claims 10-13 are subject to the present appeal. Claims 10-13 stand rejected under 35 U.S.C. 102(b) over U.S. Patent No. 3,544,374 to D'Alessandro, et al.

Status of Amendments After Final Rejection

A response was filed subsequent to the final rejection, however, no amendments were made to the claims.

Summary of the Claimed Subject Matter

The claimed invention will now be summarized with reference to the drawings being made by way of reference numerals.

Independent Claim 10

The invention recited in independent claim 10 is a method for inerting anodes of fuel cells 2 of a molten carbonate fuel cell system 1 (see page 1, lines 6; page 2, lines 17-18; page 3, lines 7-8 and page 5, lines 10-11 of the specification of the present application). The method includes supplying water vapor 6 to the anodes of the fuel cells 2 during standby operation of the fuel cell 2 in which no fuel gas is supplied to an anode half-cell of the fuel cell 2 (see page 3, lines 8-9 and page 7, lines 4-7). The method also includes applying an external voltage 7 to the fuel cells 2 to produce a reducing atmosphere at the anodes by electrolysis (see page 2, lines 9-10; page 7, lines 5-6 and 13-17).

Grounds of Rejection to be Reviewed on Appeal

The following ground is presented for review:

Whether claims 10-13 are anticipated under 35 U.S.C 102(b) by D'Alessandro, et al.

Argument

The Rejection of Claims 10-13 under 35 U.S.C. 102(b):

In rejecting claims 10-13 the Examiner stated the following in the final rejection:

"As to claim 10, D'Alessandro et al teaches a method to prevent corrosion of hydrogen permeable membranes in anodes (col. 2, lines 27-31). The method comprises applying a direct current potential between the cathode and anode of the fuel cell, thus reducing it with respect to the cathode (col. 2, lines 45-51). Furthermore, corrosion prevention is achieved by removing hydrogen from the membrane, where hydrogen removal can be achieved by flushing the membrane with an inert gas, including nitrogen, carbon dioxide, flue gas, argon, and steam (col. 2, lines 51-70). In addition, it is said that steam is used to purge all of the hydrogen from the vicinity of the membrane (col. 2, lines 70-72; col. 3, lines 1-7). It is noted that although molten sodium hydroxide is embodied for the electrolyte, it is also recognized that that molten alkali metal hydroxides and molten carbonates can be used with such an invention, thus teaching the use of molten carbonate fuel cells (col. 3, lines 59-60; col. 5, lines 27-41). Flushing the anode membrane and applying the direct current would inherently yield the anodes inert, since the applies the same process as claim 10 of the instant application.

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result of characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993).

'In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.' Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)

In the case of instant application the basis for expectation of inherency is that D'Alessandro et al.'s method uses steps employed by the instant application. Therefore, the resulting state of the anodes would be in the same state (inert) after the application of the same method.

The Examiner requires applicant to provide that that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product.

Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same... [footnote omitted] ." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F. 2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977))."

In standby operation, in operating states in which no fuel gas is supplied to the anode half-cell, it is necessary to prevent damage of the anode material by oxidation. This is accomplished in the present invention by applying an external voltage and supplying the anode half-cell with water vapor which reacts with the carbon dioxide that is present to form hydrogen and carbonate ions. The carbon dioxide that is required enters the anode half-cell from the cathode half-cell via the electrolyte. At the same time, the carbonate ions with a double negative charge that are formed in the anode half-cell defuse in the cathode half-cell. The migration of the carbon dioxide and the carbonate ions is driven by diffusion and is thus based on concentration differences of the gasses present in the anode half-cell and cathode half-cell. Thus, the reaction that occurs in the anode half-cell in standby operation is just the opposite of the reaction that occurs in standard operation. The absolute requirement for the above-described reaction to start to occur is the application of an external voltage, so that a current flows, specifically, in the opposite direction of current flow from normal operation (electrolysis).

The patent to D'Alessandro, et al. discloses a fuel cell with D.C. potential means and a method of operating same. The method of D'Alessandro, et al. protects a membrane used for the anodes of the fuel cell from the corrosive effects of the electrolytes, when no hydrogen is provided to the anode. During normal operation, the hydrogen prevents the corrosion. In order to prevent the corrosion in the instance when hydrogen supplied to the anode stops, a uniform voltage is supplied between the anode and the cathode so that the membrane is held a negative to the cathode. Furthermore, during turning on and turning off of the cell, the membrane should also be held in a hydrogen free environment. To remove the hydrogen, the anode and the membrane are rinsed with an inert gas, for example steam.

Contrary to the presently claimed invention, in D'Alessandro, et al. during the times of turning on and turning off there is no hydrogen produced. Additionally, the voltage applied between the anode and the cathode does not induce electrolysis.

The Examiner takes the position that electrolysis takes place when a DC current is provided. Applicant submits that the Examiner's interpretation of D'Alessandro, et al. is incorrect. In D'Alessandro, et al., there is no electrolysis taking place.

It is true that D'Alessandro, et al. apply a voltage to protect a membrane on the anode. This does not, however, automatically or inherently mean that electrolysis is present. Electrolysis only takes place if a certain minimum voltage is applied, which is known as a decomposition voltage. Only when this decomposition voltage is applied is the binding force of the molecules broken and a current flow occurs.

That no electrolysis takes place is also evident in D'Alessandro, et al. in that the anode is flushed only with inert gasses (see column 2, beginning with line 64 of

D'Alessandro, et al.). D'Alessandro, et al. specifically mention steam as a suitable gas. If, however, electrolysis were present, a non-inert gas would be present in the vicinity of the anode. This, however, is directly the opposite of what is intended by D'Alessandro, et al.

For reference purposes, enclosed herewith are two pages printed from the website Wikepedia dealing with electrolysis. The pages are from the German language version of Wikepedia. On the second page, applicant has highlighted a passage, and has provided a verified translation of this passage which reads "the minimum voltage that must be applied for electrolysis is known as the decomposition voltage ($U_z$or E_z) . This voltage or a higher voltage must be applied for electrolysis to proceed at all." Additionally, pages 6-11 of the text book Elektrochemie I are enclosed. A highlighted portion of the text is accompanied by a verified translation. This passage also discusses the decomposition voltage which must be exceeded in order to have electrolysis. Also enclosed is German reference DE 19622693 as technological background. In column I, lines 1-17, the reference states that with shutting down of the electrolysis plants, a protective potential is applied. However, the voltage is held sufficiently low so that no electrolysis takes place. Thus it is possible to apply a voltage as in D'Alessandro, et al. without causing electrolysis to take place. Since D'Alessandro ,et al. do not mention applying a voltage to induce electrolysis they cannot disclose electrolysis simply because a voltage is applied.

Applicant submits that the Examiner is misinterpreting the teachings of D'Alessandro, et al. Although D'Alessandro, et al. apply a voltage to protect the membrane on the anode, it is not inherent that electrolysis is present. D'Alessandro, et al. do not disclose applying an external voltage to the fuel cells to produce a reducing atmosphere at the anodes by electrolysis. There is no disclosure of applying a voltage to induce electrolysis, as in the present invention. The Examiner's assertion that electrolysis would be inherent in D'Alessandro, et al. is misplaced.

D'Alessandro, et al. do not disclose the method step of applying an external voltage to the fuel cells to produce a reducing atmosphere at the anodes by electrolysis. Applicant submits that no electrolysis takes place in D'Alessandro, et al. because the anode is flushed with only inert gasses. If electrolysis were present a non-inert gas would be present in the vicinity of the anode. As has previously been pointed out, this is directly the opposite of what is intended by D'Alessandro, et al.

Furthermore, based on the case law cited by the Examiner, "the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed.Cir. 1993)." The Examiner correctly goes on to cite Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) for the holding that "the Examiner must prove a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teaching of the applied prior art." To do this, the Examiner has merely stated that "the basis for expectation of inherency is that D'Alessandro et al.'s method uses steps employed by the instant application." Applicant submits that this on its face does, not meet the requirements of Ex parte Levy. The Examiner has provided no basis in fact and/or technical reasoning to support her determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. There is nothing in the teachings of D'Alessandro, et al. which would suggest applying an external voltage to the fuel cells to induce electrolysis to produce a reducing atmosphere at the anodes. As has previously been pointed out, there is no discussion or disclosure by D'Alessandro, et al. of electrolysis taking place. There is no disclosure by D'Alessandro, et al. of imparting sufficient voltage to induce electrolysis. Thus, one skilled in the art would logically take away from the teachings of D'Alessandro, et al. that the voltage is smaller than the decomposition voltage

necessary for electrolysis to take place. The voltage of D'Alessandro, et al. is disclosed to only serve as a protection potential.

Furthermore, in the Examiner's response to arguments section of the Office action of May 20, 2008, the Examiner makes a number of conclusory statements rather than provide the "basis and fact and/or technical reasoning" which is required to support the rejection based on inherency. The Examiner states that "The fact that D'Alessandro, et al. does teach of flushing with inert gases, it does not negate the fact that steam is taught to be used, wherein steam (water vapor) electrolyzes upon the application of a current." The Examiner states that no proof has been provided, that the process used by D'Alessandro, et al. would not inert via electrolysis of the steam. Applicant asserts that D'Alessandro, et al. specifically mention steam as a suitable inert gas (See column 2, beginning with line 64). As has been previously pointed out, in order for electrolysis to take place a non-inert gas would be present, which is directly the opposite of what D'Alessandro, et al. intend. Therefore, applicant submits that the position taken by the Examiner on inherency is totally contrary to the teachings and disclosure of D'Alessandro, et al. and there is no basis in fact and/or technical reasoning that has been provided to reasonably support a determination that the allegedly inherent characteristic necessarily flows from the teachings of D'Alessandro, et al.

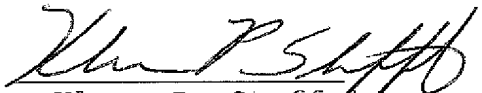
Thus, it is submitted that D'Alessandro, et al. do not disclose the claimed invention.

Conclusion

Accordingly, in view of the above considerations, it is applicants position that the Examiner's rejections of claims 10-13 under 35 U.S.C. 102 (b) is in error and should be withdrawn.

The amount of $540 to cover the fee for filing an appeal brief has been previously submitted. Any additional fees or charges required at this time in connection with this application should be charged to Patent and Trademark Deposit Account No. : 02-2275.

Respectfully submitted,
Lucas & Mercanti LLP

By 
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Dated: February 12, 2009

CERTIFICATE

I hereby certify that this correspondence is being EFS-Web or facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on February 12, 2009.

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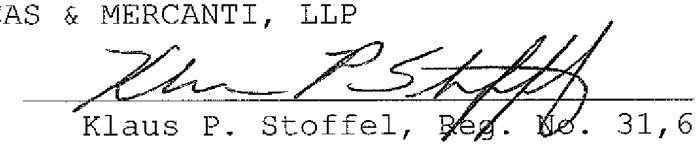
BY: 
Klaus P. Stoffel, Reg. No. 31,668

Claims Appendix

10. A method for inerting anodes of fuel cells of a molten carbonate fuel cell system, comprising steps of:

supplying water vapor to the anodes of the fuel cells during standby operation of the fuel cell in which no fuel gas is supplied to an anode half-cell of the fuel celli and

applying an external voltage to the fuel cells to produce a reducing atmosphere at the anodes by electrolysis.

11. The method according the claim 10, and further comprising the step of supplying CO2 to the anodes through a fuel gas inlet in addition to the water vapor.

12. The method in accordance with claim 11, including initially supplying mainly CO_2 for effecting immediate inerting of the anodes, and then reducing an amount of CO_2 that is supplied with increasing supply of water vapor.

13. The method in accordance with claim 10, and further comprising the step of initially supplying mainly CO_2 for effecting immediate inerting of the anodes and subsequently reducing an amount of CO_2 being supplied with increasing supply of water vapor.

Evidence Appendix

Exhibit A Translation Certification of Frank C. Farnham Company, Inc. for the except from Wikipedia on Elektrolyse, along with the German Wikipedia encyclopedia on the Internet. This reference was entered and considered by the Examiner as indicated under No. 5 on pages 5 and 6 of the Office Action of May 20, 2008.

Exhibit B Translation Certification of Frank C. Farnham Company, Inc. for the English Translation of the Article: Hamann C.H. and W. Vielstich: Electrochemistry I. Conductivity, Potentials, and Phase Boundaries. (Elektrochemie I. Leitfillhigkeit, Potentiale, Phasengrenzen.) 2nd Edition, 1985, Section 1.3, p. 8 (selected excerpt), along with the German article. This reference was entered and considered by the Examiner as indicated under No. 5 on page 6 of the Office Action of May 20, 2008.

Exhibit C DE 19622693 and Translation Certificate of Frank C. Farnham Company, Inc. for lines 1-17 of Column 1 of DE 19622693. This reference was entered and considered by the Examiner as indicated under No. 3 on page 2 of the Office Action of May 20, 2008.

Related Proceedings Appendix

None.